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RECENT RECORDS OF DESERT BIGHORN SHEEP (*OVIS CANADENSIS MEXICANA*) IN EASTERN SONORA AND NORTHWESTERN CHIHUAHUA, MEXICO

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ABSTRACT—The desert bighorn sheep (*Ovis canadensis mexicana*) was extirpated from most of its range in northern Mexico and the southwestern United States by the 1980s. Several populations have been established through reintroductions in both countries, but none in the Chihuahua–Sonora border region, where we report here 3 recent records. These records suggest the possibility

of reintroducing bighorn sheep in northwestern Chihuahua and northeastern Sonora to increase the long-term viability of the species in the region.

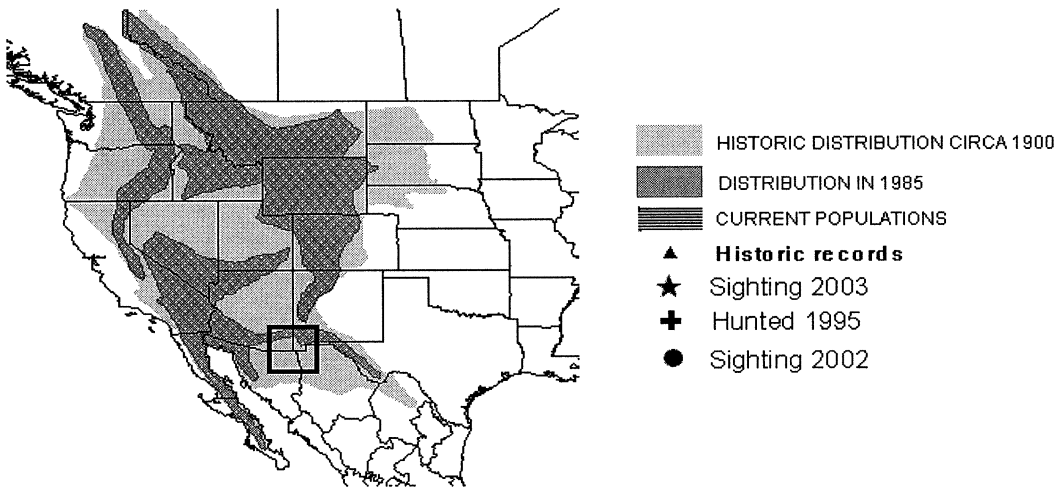
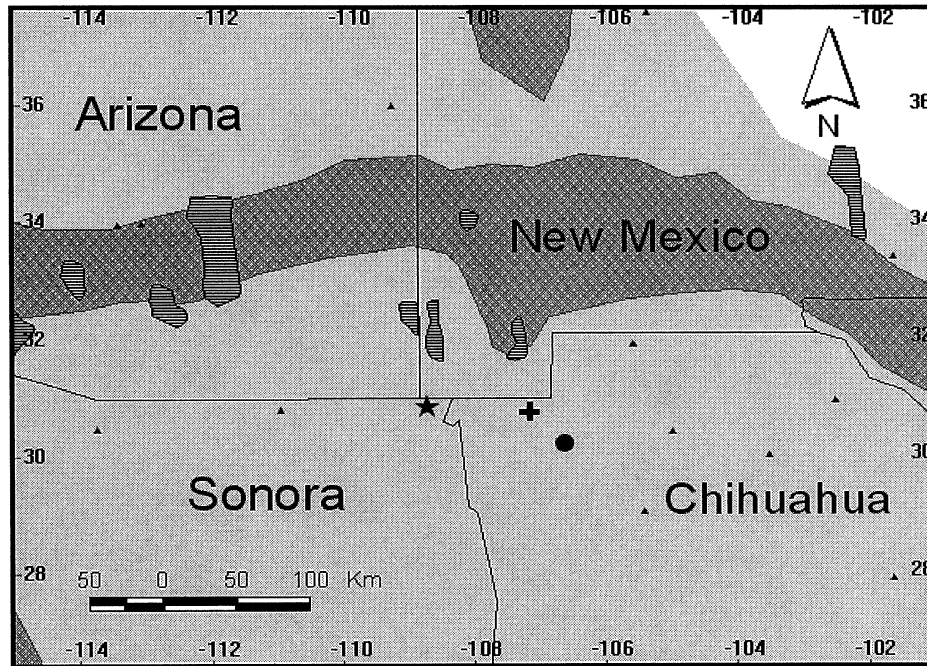
RESUMEN—El borrego cimarrón (*Ovis canadensis mexicana*) fue extirpado de la mayor parte de su área de distribución en el norte de México y el suroeste de los Estados Unidos hacia la década de 1980. Mediante reintroducciones, se han establecido varias poblaciones en ambos países, pero ninguna en la región fronteriza entre Chihuahua y Sonora, de donde se reportan 3 registros en esta nota, indicando la posibilidad de reintroducir al borrego cimarrón en el noroeste de Chihuahua y noreste de Sonora para incrementar la viabilidad a largo plazo de la especie en al región.

The desert bighorn sheep (*Ovis canadensis mexicana*) was once distributed from southern Canada to northern Mexico, along the main mountain massifs of western North America (Hall, 1981). For more than a century, desert bighorns have been one of the main species for trophy-hunting in North America, and thus, subject to legal and illegal hunting that, coupled with competition with cattle, diseases from cattle, and habitat fragmentation, decreased bighorn distribution to small and often isolated groups in inaccessible areas (Leopold, 1959; Smith and Krausman, 1988; Krausman et al., 1999; Guerrero et al., 2003). The species is listed as under special protection in Mexico (SEMARNAP, 2002) and threatened in the USA (Rubin, 1998; New Mexico Game and Fish Department, 2002). Recovery efforts in Mexico have centered on the establishment of reintroduced populations within the former geographic range, conservation of original habitat, and provision of incentives to conservation by promoting sustainable hunting. A well-known example of a successful recovery program is that on Tiburón Island (Sonora), where scientists from the National University of Mexico and non-governmental organizations organized a solid hunting program that has provided the Seri Indians, owners of the island, incentives to become wardens of both the sheep and its habitat (Medellín et al., 1999, 2005).

The historical distribution of *O. c. mexicana* in Mexico included the Baja California Peninsula, Sonora, Chihuahua, and Coahuila (Leopold, 1959; Hall, 1981). In the southwestern United States, desert bighorn sheep were found in California, eastern Arizona, and New Mexico (Hall, 1981; Shackleton, 1985; Hoffmeister, 1986). It was estimated that a million bighorn sheep historically inhabited the arid environments of the United States, but by 1980, the total population was approximately

12,000 individuals (Smith and Krausman, 1988). This critical decline prompted reintroduction efforts in Arizona, New Mexico, California, Colorado, Texas, Utah, and Nevada to recover populations across the historical range (Lee, 1999; New Mexico Game and Fish Department, 2002). In 1998, larger populations were reported in southwestern Arizona, and isolated populations in the Peloncillo and Catalinas mountains of Arizona (Lee, 1999). In 2002, small but relatively stable populations were reported in the Red Rock Wildlife Area, the Ladron Mountains (26 individuals), the Peloncillo Mountains (30 individuals), the Fra Cristobal Mountains (66 individuals), and the Big Hatchet Mountains (40 individuals) (New Mexico Game and Fish Department, 2002).

Presently, desert bighorn sheep in Mexico survive in the Baja California Peninsula and Sonora, but they have been extirpated from Chihuahua and Coahuila (Rubin et al., 1998; Medellín et al., 1999, 2005; Hayes et al., 2000; Guerrero et al., 2003). There are ongoing efforts to reintroduce the species in the Maderas del Carmen region of Coahuila (P. Robles Gil, pers. comm.) and in the municipality of Coyame in eastern Chihuahua (R. Uranga, pers. comm.). Herein, we suggest that reintroductions of *O. c. mexicana* to northwestern Chihuahua or northeastern Sonora might create a metapopulation with populations in southwestern New Mexico or southeastern Arizona, increasing viability of desert bighorn in the region. We have 2 recent reports of bighorn sheep in northwestern Chihuahua by local people (Fig. 1). The first report was in 1995, when a male was hunted by local cowboys working at an unspecified location at Las Palmas Ranch, a 30,000-ha property that borders New Mexico, just south of the Alamo Hueco Mountains and 27.8 km south from the nearest known population of bighorns in the Big Hatchet Mountains. In 2002, a male was seen



- HISTORIC DISTRIBUTION CIRCA 1900
- DISTRIBUTION IN 1985
- ▨ CURRENT POPULATIONS
- ▲ **Historic records**
- ★ Sighting 2003
- ✚ Hunted 1995
- Sighting 2002

FIG. 1—Distribution of desert bighorn sheep (*Ovis canadensis mexicana*) in the southwestern USA and northwestern Mexico, including historical and current distribution, and new records (modified from Hall, 1981; Leopold, 1985; Shackleton, 1985; Hoffmeister, 1986; Lee, 1999; New Mexico Department of Game and Fish, 2002).

crossing Federal Highway 2 (Janos–Asención) near La Lagunita (J. Harris, pers. comm.), 68 km southeast from the closest population in the Big Hatchet Mountains. The dominant vegetation in that area is desertscrub, with low plant density.

To these we add our own sighting of a male

bighorn on Los Ojos Ranch, Sonora, on 4 August 2003. We estimated this ram to be 6 to 8 years old, according to criteria defined by Smith and Krausman (1988). Los Ojos Ranch is private property from which cattle were removed in 1998; the ranch currently is used for habitat conservation and restoration. The ram

climbed a rocky slope, crossed the road we were driving, climbed another escarped slope, and descended to a rocky canyon. This sighting was 5.7 km south of the Arizona-Sonora border (UTMs 12R 0690985 E, 3436038 N), 33.5 km south from the nearest known population of bighorn sheep in the Peloncillo Mountains of Arizona. We saw this individual at a location near 2 artificial ponds and a permanent arroyo, in interior chaparral and thornscrub (Brown, 1994). This open forest community includes trees ranging from 5 to 10 m high, composed of blue Mexican oak (*Quercus oblongifolia*), shrub live oak (*Q. turbinella*), one-seed juniper (*Juniperus monosperma*), desert acacia (*Acacia farnesiana*), and thorn acacia (*A. constricta*), with an understory of beargrass (*Nolina microcarpa*), Parryi agave (*Agave parryi*), and sotol (*Dasylirion wheeleri*). The climate is subtropical-humid (García, 1988).

The observation from 2002 suggests that bighorn sheep can disperse farther than the previously reported maximum of 48 km (Shackleton, 1985). We have no documentation of the movement of ewes or the establishment of new populations in the Sonoran-Chihuahuan region. However, because of the proximity of these 3 observations to established populations in New Mexico and Arizona, it is feasible that these individuals came from the Big Hatchet and Peloncillo mountains, respectively (Fig. 1), during their summer movements. Both Los Ojos and Las Palmas ranches contain large areas of continuous habitat with the topographical and biological features required by this species; thus, these areas should be considered for future reintroductions. Reduction of populations in the Big Hatchet and the Peloncillos makes them highly prone to extinction by predation through the Allee effect (Mooring et al., 2004). Reintroductions of bighorn sheep in the mountains of northwestern Chihuahua or northeastern Sonora would increase the opportunities for dispersing individuals to find mates, thereby increasing the long-term viability of the species in the region, assuming that reintroductions would be accompanied by education of local residents to prevent hunting until new, stable populations are established.

The case of bighorn sheep in the Sonora-Chihuahua and Arizona-New Mexico international border is just one of many examples of

species, including the ocelot (*Leopardus pardalis*), jaguar (*Panthera onca*), pronghorn antelope (*Antilocapra americana sonorensis*), white-sided jack rabbit (*Lepus callotis*), black-tailed prairie dog (*Cynomys ludovicianus*), and thick-billed parrot (*Rhynchopsitta pachyrhyncha*), considered at risk of extinction in one or both countries and requiring immigration of individuals across the border to maintain viable populations (Ceballos and Navarro, 1991; Ceballos et al., 1998, 2005; List et al., 1999). There is an urgent need to address this important conservation issue in both countries to ensure the long-term survival of these taxa.

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MAXILLARY CANINES IN BIGHORN SHEEP

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ABSTRACT—Bighorn sheep (*Ovis canadensis*) occasionally have small, procumbent maxillary canines that do not penetrate the gums. However, the frequency of these vestigial teeth is only 3%. We collected 25 skulls from an isolated and indigenous population of bighorn sheep in the Silver Bell Mountains, Arizona. We compared the frequency of maxillary canines with data reported in scientific literature and in the mammalogy collection at the University of Arizona, and found a significantly higher frequency of maxillary canines in bighorn sheep skulls from the Silver Bell Mountains than in skulls collected throughout the southwestern United States. We separated skulls by sex and age and found that male and female skulls (>6 months of age at death) from the Silver Bell Mountains both had a significantly higher frequency of maxillary canines than did skulls from the Southwest. Lamb skulls (<6 months of age at death) exhibited a higher frequency of maxillary canines than did lamb skulls from throughout the Southwest; however, our small